

## Historical Accomplishments

1996—Microprocessor-based dust instrument on Mars Pathfinder rover  
2001—Solar power and dust experiment packages for Mars Surveyor Lander  
2005 and 2008—Active experiment packages on International Space Station  
2007—Triple spectrometer and hyperspectral imager flown for remote environmental sensing

## Collaboration with Case Western Reserve University to build Whegs



*Wheg 3-foot rover*

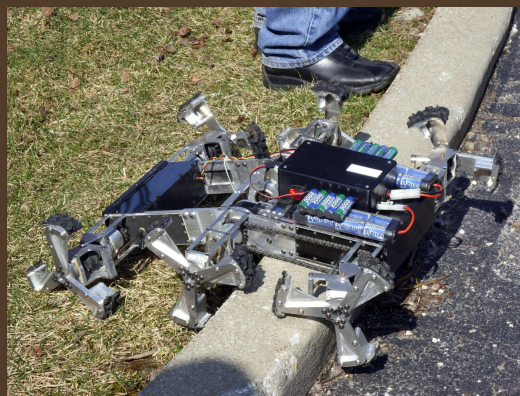


*Wheg 3-inch crawler*

*Whegs can be made to fit the size of a single sensor like a camera, seismometer or nose. They can be scaled up to be a heavily instrumented rover.*

## General Information

NASA Glenn Research Center  
[www.nasa.gov/centers/glenn/home/](http://www.nasa.gov/centers/glenn/home/)  
Glenn Test Facilities Guide  
[http://facilities.grc.nasa.gov/documents/facilities\\_Booklet\\_2005.pdf](http://facilities.grc.nasa.gov/documents/facilities_Booklet_2005.pdf)  
Glenn Research Center Resume  
[www.nasa.gov/centers/glenn/about/](http://www.nasa.gov/centers/glenn/about/)  
Business Development and Partnership  
<http://newbusiness.grc.nasa.gov>



*Climbing the curb*



*CRATOS climbing the stairs*

## Business Development and Partnership Office

Dr. Robert (Joe) Shaw, Chief  
21000 Brookpark Road, MS 49-5  
Cleveland, OH 44135

Phone: 216-977-7135  
Fax: 216-977-7133  
E-mail: [Robert.J.Shaw@nasa.gov](mailto:Robert.J.Shaw@nasa.gov)

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National Aeronautics and  
Space Administration



## Robotics



[www.nasa.gov](http://www.nasa.gov)

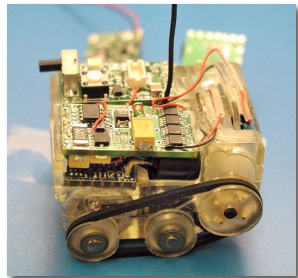


## Cost-Effective Research Prototypes

- Modular
- Off-shelf solutions
- Expendable (\$1 to 5K for parts)
- On-time, on-schedule prototypes

## Design Capabilities

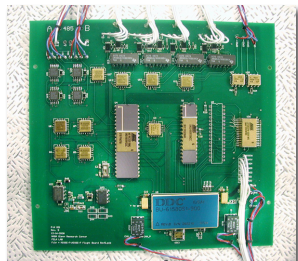
- Video, audio, and photographic
- Secure communications with swarm capability
- Sensing (gas, H<sub>2</sub>, S<sub>2</sub>, etc.)
- Power—long duration (2 to 10 hrs)
  - Fuel cell, Stirling, Battery, Flywheel
  - Photovoltaic (solar)
- Radiation / combustible environments
- Hot and cold environments (–40 to 150 °F)
- Size—2 inches to 3 feet
- Dust and soil mitigation
- Safe stand-off distance (up to 1 mile)
- Climbing capability
- Design for unique requirements in direct support of specific projects and customers



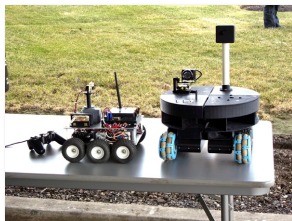
Two-inch crawler



One-foot robots



Communications



Robots shown at Homeland Security demonstration

## Communications

The goal of this competency is to develop communications systems and networks based on

- radiofrequency components and devices
- digital and wireless communications systems
- communications networking techniques

Health monitoring and maintenance scheduling could be addressed.

## Electrochemistry

- Batteries—versatile, reliable, safe, modular lightweight, portable energy sources.
- Fuel cells—primary source of power by converting hydrogen and oxygen to water and electricity
- Regenerative fuel cells—combine a fuel cell with an electrolyzer capable of converting water back into hydrogen and oxygen (functions like a battery).

## Instrumentation and Controls

Responsible for

- conducting and directing basic and applied research
- advanced instrumentation
- controls technologies for aerospace propulsion and power applications

This advanced research in harsh environment sensors, high-temperature, high-power electronics, micro/nano electromechanical systems, high data rate optical instrumentation, active and intelligent controls to enable self-feeling, self-thinking, self-reconfiguring, and self-healing systems.

## Materials

This competency develops processes and characterizes materials for aerospace applications. Metallic, ceramic, and polymeric materials are the current focus, both monolithics and composites. It is possible to enable and extend component durability by understanding, developing and demonstrating the feasibility and viability of advanced coatings.

## Mechanical Components

Component fatigue testing enables the development of advanced materials, processing, and coatings for gears and bearings. Advanced lubrication technology enables high-speed gear systems. System testing of advanced components and analytical tool development for condition-based maintenance of mechanical structures is another capability.

## Photovoltaics

The objective of this competency is to develop future high-efficiency photovoltaic cells with high-power/mass ratios. Capabilities include high-power, lightweight systems, including development of robust, easily deployed, high-efficiency arrays.

## Program Management

The ~100 project and program managers at Glenn have experience in managing 119 Centaur rocket launches, the Space Station Freedom power system, Ares launch vehicle systems, as well as numerous electric propulsion, communications, aeropropulsion, and microgravity projects.

## Simulation and Modeling

The objective of this competency is design and modeling to identify systems as well as components. Virtual reality techniques support the design of new technologies, and the simulation of environments provide testing for systems and components.

## System Analysis and Engineering

This competency focuses on using tools to analyze aerospace vehicles, propulsion, and power concepts. It is focused on the development and maintenance of systems engineering processes and the application of engineering processes at a systems level.

## Thermal Energy Conversion

This competency focuses on the development of thermal energy at the subsystems and systems level as well as verifying the performance of the system, such as Stirling engines.



CRATOS collecting dirt samples, autonomously operated instrumentation suite